BIOLOGICAL CLASSIFICATION.

Dawn of Civilisation → many attempts to classify living organisms.

↓

Done instinctively not using the criteria that were scientific but borne out of need to use organism for our own use – Food, Shelter, Clothing.

ARISTOTLE → Earliest to attempt more scientific basis for classificat.

- presence/absence of RBC → Animals
  - Enaima (absent RBC)
  - Anaemia.
- Used simple morphological characters. → Plants
  - Herbs
  - Shrubs
  - Trees.

LINNEAUS → Two Kingdom System of classif. → used Gross morphological characters

- Plantae
- Animalia

* Did not distinguish b/w prok. & euk.
  unicell. & multicell.
  Photosynth. & non-photosynth.
* Large no. of organisms did not fall into either category (plant & Animalia)
* Besides, gross morphological charac., a need was felt to include
  - Cell str.
  - Nature of wall
  - Mode of nutrition
  - Habitat
  - Method of Reprd.
  - Evolutionary relationship

* Classification systems for living organism have undergone several changes over the time.
* Though, plant kingdom, Animal kingdom → have been constant over the time, under all diff. systems the understanding of what groups / organism be included under these kingdom have been changing, number & nature of other kingdom have been understood differently by different scientists over time.

R.H Whittaker (1969) → Five Kingd. classific.

based on

- Cell structure
- Body org.
- Mode of nutrition
- Repr.
- Phylogent. relationship.

Six kingdom Classif.

Three domain system

- Monera
  - Archaebact.
  - Eubact.
- Protista
- Fungi
- Plantae
- Animalia

It has brought together Chlamyd. & chlorella. with Paramoecium & Amoeba.

* Over the time an attempt has been made to evolve a classific system. which reflects not only on (1) morph., (2) physiolog. (3) & reproduct. similarities but is also phylogenetic.

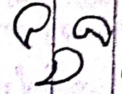
KINGDOM MONERA

→ Bacteria are cosmopolitan in nature.

• Bacteria – sole members – most abund. micro-organisms – occur almost everywhere – Hundereds of Bac. in handful of soil.

↳ can live in extreme habitats → Hot springs, Snow & deep ocean, Deserts (where a very few other life forms can survive)

Cocci (spherical) — Bacillus (Rod shaped) — Spirillum (spiral)



(Comma shaped) Vibrium

* Many of them live in or on other organisms as parasite.

* Bact. struct. is very simple but very complex in behav.
↳ most extensive metabolic diversity
- Autotrophic
  - Photosynth. auto. ← use light
  - Chemosynth. auto. ← use inorganic substance.
- Heterotrophs (vast majority)

EUBACTERIA

* Thousands of true bact.
* Characterised by : Presence of rigid wall & if motile, a flagellum

Chemosynthetic Autotrophs :

• Oxidise inorganic (1) subst. such as (2) nitrates, nitrites & (3) ammonia & use the released energy for their ATP prod.

• Play a great role in recycling nutrients like N, P, S, Fe

Some are pathogens causing damage to human beings, crops, farm animals & pets.
↓
Cholera
Typhoid
Tetanus
Citrus Canker.

CYANOBACTERIA :

→ Blue green algae
→ Have chl-a (similar to green plants)
→ Photosynth. autotr.
→ Unicellular
→ Colonial
→ Filamentous (2)
→ Freshwater / marine or (3) terrestrial algae.
* Colonies surrounded by gelatinous sheath.
* Often forms bloom. in polluted water bodies
* Can fix atm. N_2 in Heterocyst.
  - Nostoc
  - Anabaena.

Heterotrophic Bact. → (1) most abundant in nature
- majority are imp decomposer
- significant impact on human affairs
- (1) making curd (2) antibiotic prod. (3) Fixing N_2 in legume roots

ARCHAEBACTERIA

* Special since live in most harsh habitats such as extremely
  - (1) Salt areas (HALOPHILES)
  - (2) Hot springs (thermoacidophiles)
  - (3) marshy area (methanogens) → in the gut of ruminant animals. cow, buffalo → prod. of methane (biogas) from dung.

* Archaebact. differ in 1) having dif. cell structure
↓
resp. for survival in extreme nature

Bact. → reproduce mainly by → Fission
- unfav. cond. → Spores
- Sexual repr. → Primitive method of DNA transfer from one bact. to other.

Mycoplasma :
* completely lack cell wall
* Smallest living cell
* Can survive without oxygen.
* Pathogenic to → plants, → Animals

KINGDOM PROTISTA → They reproduce both sexually as well as asexually.

* All unicellular eukaryotes.
* Nucleus & well-membrane bound organelle present.
* Some have flagella or cilia.
* Protist reproduce → asexually
  → sexually → cell fusion & zygotic formation – zygotic meiosis

* Boundaries of this kingdom are not well defined. (A "photosynth. protist" to one biologist may be a "plant" to other)
* Members of protista primarily aquatic.
* This kingdom forms link with other plants, animals, fungi.

CHRYSOPHYTA

→ Diatoms (chief prod. in oceans)
→ Desmids (golden algae)

Found in → Fresh water
→ Marine environ.

* Microscopic
* Float passively in ~~cold~~ water currents (planktons).
* Most of them are photosynth.

Cell walls → Two thin overlapping shells
↓ fit as
Soap box.

* Walls embeded with silica, hence indestructible
↓
Left behind large amt of cell wall deposits in their habitat (accum. over billion years)
↓
"Diatomaceous Earth"
↓
Gritty → Used in polishing, Filteration of oils & syrups

DINOFLAGELLATES

* Mostly marine & photosynthetic.
* Appear → Yellow, green, brown, blue or red depending on main pigments in cell.
* Cell wall has stiff cellulosic plates on outer surface.
* Two flagella → longitudinal
  → transverse (in a furrow) b/w wall plates.
* Red dinoflagellates (Gonyaulax) → Red tide (rapid multiplication)

* Toxin released by such large number —kill→ other marine anim. like fishes

EUGLENOIDS

* Majority – Fresh water – stagnant.
* No cell wall, but protein rich pellicle → makes body flexible.
* Two flagella → short
  → long
* Pigments identical to higher plants
* Photosynth (in sunlight)
  Heterotroph/Predating (Deprived of ☼)

SLIME MOULDS

* Saprophytic protists
* Body moves along decaying twigs & leaves engulfing org. material.
* Under suitable cond, —form aggreg.→ Plasmodium (grows & spread all over several feet)

During unfav. cond. —plasmod. differentiate→ Forms fruiting bodies bearing spores at tips.

Spores:
1. dispersed by air currents.
2. extremely resistant
3. True walls
4. survive many years, even under adverse cond.

PROTOZOANS

* All protozoans – heterotrophs & live as predators or parasite.
* Primitive relative of animals.

Amoeboid proto.	Flagellated	Ciliated	Sporozoans
* ~~Fresh water~~, ~~Sea water~~, Moist soil.	* ~~Freeliving~~ or ~~parasite~~	* Aquatic	* Has infect. spore like stage in life.
* Move & capture their prey by pseudopodia (false feet)	* have flagella	* actively moving due to 1000s of cilia.	* Most notori-ous (malarial parasite) causes malaria, disease having stagg-ering effect on human population
* Many forms have silica on their surface	* Caused disease such as sleeping sickness	* Has cavity (gullet) that open to outside of cell surface.	
Eg. Amoeba	Eg. Trypanosoma	* Coordinated movem. of cilia causes food to be steered into gullet	
Some are parasite (Entamoeba)		Eg. Paramoecium	

KINGDOM FUNGI → cell wall : chitin & polysaccharide.

Refrigerator - prevents bacterial or fungal infections.

(*) Unique Kingdom of heterotrophic org.

(*) Common toadstools and mushrooms are also fungi.

(*) Unicellular fungi → yeast → used in bread & beer.

(*) Antibiotic source : penicillium

(*) Fungi → cosmopolitan → air, water, soil; → animals, plants
↳ grow : warm & humid places.

(*) Great diversity in morphology & habitat

(*) White spots on mustard leaves → fungus (parasitic)

(*) Other fungi causes disease → plants → rust causing Puccinia; → Rust

Fungi → on maize; → on Rotten fruits.

⊙ With exception of Yeast, fungi are filamentous.
↓
Body consists of long, slender, thread like structures called hyphae.
→ Network of hyphae : Mycelium

⊙ Some hyphae → continuous tubes filled with multinucleate cytop. → Coenocytic hyphae

Other have → septate or cross wall → in hyphae.

(*) Most fungi are heterotrophic
→ Saprophytes : absorb soluble organic matter from dead substrate.
(On living plants & animals : PARASITE)
→ Symbionts : With algae as lichens
→ Mycorrhiza : With roots of higher plant.

(*) Reproduction (vegetative means)
→ Fragmentation
→ Fission
→ Budding

(*) Asexual Repr. : By spores
→ Conidia
→ Sporangio spore
→ Zoospore.

(*) Sexual cycle : 3 steps
- Plasmogamy : Fusion of protoplasm b/w two motile or non motile gametes :
- Karyogamy : Fusion of two nuclei.
- Meiosis (In zygote haploid spores)

P → K → M

(*) Sexual Repr. :
→ oospore
→ ascospore
→ Basidiospore.

Fungus reproduces sexually, two haploid hyphae of compatible mating type fuse.

Immediate fusion → Diploid cell (2n)

Intervening (n+n) DIKARYOTIC STAGE → dikaryophase → Basidio & Ascomycetes
↓
Later parental nuclei fuse & cells become diploid.
Fruiting body —meiosis→ spores (n)

* Various spores are produced in distinct structure called fruiting bodies.

1. The morphology of mycelium
2. Mode of spore formation
3. Fruiting bodies

} → Forms basis of classific. of kingd. into various classes.

Phycomycetes

- Found in : aquatic habitats
  - decaying wood in moist
  - Damp places
  - (Obligate parasite on plants.)
- Mycelium : Aseptate & Coenocytic
- Asexual Reproduction
  - Zoospores (motile)
  - Aplanospores (non motile)
  - produced endogenously in sporangium.
- Zygospore : Fusion of two gametes
  - similar in morphology (isogamous) OR dissimilar (anisogamous)

Example : Mucor (Dung mould)
Rhizopus (Bread mould)
Albugo (parasitic fungi on mustard)

Ascomycetes

- Sac fungi
- Mostly multicellular (eg. penicillium)
- Rarely unicellular : Yeast (Sacchromyces)
- They are saprophytic, decomposers, parasitic or coprophilous (growing on dung).

Mycelium : Branched & septate mycelium

Asexual spores → conidia (exogenously, conidiophores)

Sexual spores → Ascospores (endogenously)
Sac like (asci) arranged in diff. types of fruiting bodies – Ascocarps

Example : Aspergillus
Claviceps
Neurospora – extensively used in biochem & genetic work.
Morels & Truffles – delicacies

Basidiomycetes

In soil, on logs, Tree stumps, Living plant bodies as parasites. Eg. Rusts & Smuts

Mycelium : Branched & Septate.
Asexual spore : Not found generally.
Veg reproduction : Fragmentation.
Sex organs : absent.
Plasmogamy brought about by fusion of two veg. or somatic cells of differ. strains or genotype.
results into dikaryon
↓
Basidium – (1) Karyogamy & (2) meiosis takes place here
basidia arranged in fruiting body – Basidiocarps
produce 4 basidiospore (exogenous)

Eg. Agaricus (Mushroom)
Ustilago (smut)
Puccinia (Rust fungi)

Deuteromycetes

- Imperfect fungi. (Only the asexual or veg. phases of fungi are known)
- When sexual form discovered → moved to classes they are belonged.
- Its possible that asexual & veg stage has been given one name placed under deuteromycetes. And (perfect) sexual stage under another class (often basidiom., ascomy).
- Later when linkage established, fungi identified correctly & moved out.

The deuteromycetes reproduce only by asexual spores – conidia.

Mycelium : Branched & septate.

Some members are saprophytes or parasites while a large number of them are decomposers of litter & help in mineral cycling.

Eg : Alternaria, Colletotrichum, Trichoderma.

→ have prominent chloroplast.

KINGDOM PLANTAE

Contains all eukaryotic chlorophyll-containing → plants.

Few members → partially heterotrophic

- Insectivorous plants
  - Bladderwort
  - Venus flytrap
- Parasite
  - Cuscuta

- Alternation of generation present

KINGDOM ANIMALIA

- They directly or indirectly depend on the plants for food.
- They digest the food in an internal cavity and stored food reserves as glycogen or fat.
- Mode of nutrition: Holozoic - ingestion of food.
- Follow → Definite growth pattern → adults → definite shape & size
- Higher forms → elaborate sensory, motor (neuromotor) → mechanism.
- Most of them are capable for locomotion.
- Sexual reproduction followed by embryological development.

VIRUSES, VIROIDS, PRIONS AND LICHENS

→ acellular.

Viruses: • Not 'truly' living (if we understand living as those org. that have cell structures)

Non cellular org. having inert crystalline structure outside living cell.

Date / /
Page

Once they infect → Take over the machinery of host cell
↓
To replicate themselves, killing the host.

Name: VIRUS meaning venom or poisonous fluid → Pasteur

Recognised certain microbes as casual organism of TMV (Tobacco mosaic Virus). These are smaller than baderia & pass through bacteria proof filter. (VIRUS → D.J Ivanowsky (1892)

Demonstration: Extract of Infected plants of tobacco —cause infection→ In healthy plants → M.W Beijerick (1898)

∵ Hence called, Contgium vivium fluidum (Infectious living fluid)

Virus can be crystalised & crystals consists largely of proteins. They are inert outside host cell. (their specific)
Virus are obligate parasite. → W.M Stanley (1935)

* In addition to proteins, viruses also contain genetic material, could be EITHER rna or dna.

Virus → nucleoprotein → genetic material infectious

imp

Virus infecting plant → SS RNA

Virus infecting animals → SS or ds RNA OR ds DNA

imp

imp

Bacterial virus / Bacteriophages → Usually ds DNA.

Protein coat : Capsid : made of small subunits capsomeres (1)
↓ protects
Nucleic acid.
arranged in helical or (2) polyhedral form (geometric form).

Viral Disease : Mumps, Small pox, Herpes, Influenza, AIDS → In animals

In plants

Dwarfing | mosaic formation. | Stunted growth | Vein clearing | leaf rolling & curling | yellowing

Viroids : 1971, T.O. Diener
Infectious particle smaller than virus
Caused Potato spindle Tuber Disease
Free (RNA) → of low molecular weight
Lacks protein Coat

Prions : • In modern medicine, certain infectious neurological diseases were found to be transmitted by an agent consisted of abnormally folded protein.
• Size similar to virus

Diseases: Bovine Spongiform encephalopathy

most notable disease ← (BSE) → Mad cow disease in cattle

↓ analogous variant

Cr-Jacob disease (CJD) in humans

also mutualism

Lichens: Symbiotic associations - mutually vague

Algae	Fungi
Phycobiont	Mycobiont
↓	↓
Autotrophs	Heterotrophs
↓	↓
Prepare food for fungi	Provide Shelter, absorb mineral nutrients & water.

Lichens are so close in their association, indistinguishable

↳ Very good pollution indicators.